

REMARKS

This Amendment is in response to the Office Action dated May 23, 2005. In that Office Action, claims 1-6 and 8-12 were rejected under § 102(e) as being anticipated by *Cole et al.* (US Patent No. 6,444,214).

As amended, this application is believed in condition for allowance. Claim 1 has been amended to differentiate over *Cole et al.*, in particular, to positively recite that the water-dispersible binder is an **emulsion binder** having salt-sensitive dispersibility in tapwater while remaining nondispersible in more concentrated salt solutions. The amendments to Claim 1 are supported in the application as filed, p. 3, line 20- p.4, line 15. By way of the foregoing amendments, Applicant has also amended Claim 1 to clarify the Tg of the polymer. More specifically, it has been amended to state that the "polymer has a Tg of from -40°C to +105°C." This clarification is supported by the application as filed, p. 6, ll. 14-15. Further, the Applicant has added Claim 13 to state specific tensile strengths of the fibrous web in tap water and in 3 percent aqueous inorganic salt solution. Claim 13 corresponds to original Claim 7 and is supported by the application as filed, p. 7, ll. 21-25, and believed allowable. Finally, the Applicant has added Claim 14, which is directed at a nonwoven material consisting of a web of fibers and salt sensitive, water dispersible emulsion binder. Claim 14 is supported by the application as filed, p. 9-14, Examples 1-8. The amendments are believed to clearly overcome the anticipation rejection. Section 102(e) requires the presence of identical elements to reject an invention as anticipated by another. However, the claimed subject matter, as amended, is clearly distinct from *Cole et al.* *Cole et al.* does not address or even remotely suggest either emulsions or salt-sensitive, water dispersible residue binders formed thereof. Accordingly, the present invention, as currently claimed, is not anticipated in any way by *Cole et al.*

*Cole et al.* describes water-soluble salt-sensitive polymers **not** emulsion binders that can disperse in water. *Cole* describes *solutions*, containing highly water *soluble* polymers, which form water *soluble* binders. On the other hand, the present invention describes

*emulsions*, containing *insoluble* polymers that form water *dispersible* products. In other words, the present invention achieves water *dispersibility* of emulsion residue binders, despite the fact that the binders are not fully water-soluble; they form an emulsion with water. In this regard, the distinction between *dispersibility*, ability of matter to break into filterable miniscule fractions, as opposed to *solubility* is important:

Dispersible, as used herein, means that in tap water, a film formed from the polymer breaks into small discrete pieces or particles that can be filtered out. These pieces are capable of being filtered from the water. While not being bound to a theory, it is believed that the dispersion of the polymer film is related to the fact that a film forms from an *emulsion* by coalescence of polymer particles, forming weak bonds between particles. In water, some bonds between the particles will break, resulting in clusters of polymer particles. ***This is different from a solution polymer in which polymer chains mix and entangle during film formation, and this film dissolves into individual polymer chains, which cannot be filtered.***

*Application as filed, p.4, ll. 1+*

*Cole et al.* forms water soluble binders from polymer solutions containing mostly Acrylic Acid ("AA"). The Examiner's attention is directed to *Cole's Table 5* reproduced below.

TABLE 5

Sulfonate Anion Modified Acrylic Acid Terpolymers					
Sample	% AMPS	% NaAMPS	% AA	% BA	% EHA
1	0.0	3.0	64.0	22.5	10.5
2	0.0	3.5	63.5	22.5	10.5
3	0.0	3.9	62.1	24.6	9.4
4	0.0	4.0	57.0	26.5	12.5
5	0.0	4.2	64.7	19.7	11.4
6	0.0	5.0	58.0	26.5	10.5
7	0.0	4.0	63.0	21.5	11.5
8	0.0	5.0	59.0	25.5	10.5
9	0.0	5.0	60.0	24.5	10.5

As shown in **Table 5**, about 58%-64% of *Cole's* polymer solution consists of AA. The other components include Butyl Acrylate ("BA"), 2-Ethylhexyl Acrylate ("EHA"), and 2-Acrylamido-2-Methyl-1-PropaneSulfonic Acid Salt ("NaAMPS"). It is further noted that AA, the main component of *Cole's* solution, is highly water-soluble<sup>1</sup>. In fact, any potential reactions causing substantial water-insoluble bonds such as cross-linking or hydrophobic orientations are eliminated with inhibitors, surfactants, or neutralization to increase water solubility. *Cole*, col. 14, ll. 56-61; col. 17, ll. 15-25; col. 9, ll. 48-51 (respectively). Note also *Cole's* **Table 7** reproduced below showing AA-based polymeric solutions having almost complete solubility in de-ionized water containing less than 10ppm salt.

TABLE 7

Sample	Solubility Results			
	Solubility in Ca <sup>2+</sup>			
	<10 ppm	50 ppm	100 ppm	200 ppm
Sample 1	100	94	78	12
Sample 2	100	100	98	91
Sample 3	100	60	36	2
Sample 4	99	100	97	90
Sample 5	100	97	88	19
Sample 6	100	100	99	90
Sample 7	89	42	31	0
Sample 8	100	96	96	90
Sample 9	100	73	78	7
Sample 10	100	100	100	90

The present invention, on the other hand, has achieved a different and unpredictable result. It is directed at water insoluble polymers that form water dispersible products. In this regard, Examiner's attention is directed to the *Declaration of John C. Parsons*, attached hereto as Appendix A, stating that formation of salt-sensitive, water dispersible emulsion residue binders from insoluble polymers is highly surprising and unexpected by one skilled in the art, especially due to the low solubility properties of the binders' components.

<sup>1</sup> Acrylic Acid is completely miscible in water. See Chemical Safety Information from Intergovernmental Organizations, <http://www.inchem.org/documents/icsc/eics0688.htm>.

In particular, the present invention describes emulsion polymers which are based on Methacrylic Acid (MAA). Even though AA and MAA are both carboxylic acids, they have very different solubility properties in water. More specifically, AA is a highly water-soluble polymer, while MAA polymer consists of larger, more complex monomers, which are only moderately soluble in water<sup>2</sup>. In fact, high concentrations of MAA polymer create emulsions as noted in the Examples. In this regard, the present invention lists 8 examples to demonstrate that the tensile strength of a fibrous web treated with an aqueous emulsion polymer is substantially reduced in tapwater or de-ionized water. Note *Application*, Examples 1-8, p. 9-14. In all the examples, MAA makes up almost 60% of the emulsion polymer. The result derived from the Examples in the current application shows that the emulsion polymer residue disperses in water containing less than 0.5 percent by weight salt, despite its low solubility properties.

This conclusion is unexpected and clearly distinct from *Cole's* which is concerned with salt-sensitive, water-soluble polymers. Therefore, in accordance with the present invention and *John C. Parson's Declaration* it is clearly seen that ***emulsion residues*** containing *insoluble* polymers can form superior and unexpected products in the form of salt sensitive, tapwater dispersible binders.

It is noted that polymer emulsions have many advantages over polymer solutions. For one, emulsions can be made with less water than solutions, lowering shipping costs and potential for damage to a web from too much applied water after formation. Likewise, emulsion polymers can be used directly with the present invention, without the need for removing solvent, re-dissolving and so forth. The invention thus provides for reduced waste and adverse environmental impact due to solvent use. So also, polymer emulsions are more stable than solutions, which tend to precipitate over time. The invention accordingly also provides for a more durable product which is cheaper to ship. Furthermore, emulsion

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<sup>2</sup> Methacrylic Acid is moderately miscible in water (i.e. 89 g/L). See Chemical Safety Information from Intergovernmental Organizations, <http://www.inchem.org/documents/icsc/icsc/eics0917.htm>; <http://www.inchem.org/documents/sids/sids/79414.pdf>.

polymerization techniques provide better yield and faster rate, while maintaining good temperature control, negligible viscosity change and allow for more compositional flexibility. The present invention clearly exhibits numerous advantages over *Cole et al.*

For the reasons stated above, and in light of John Parson's enclosed declaration, the application, as currently amended, is believed to be in condition for allowance. *Cole et al.* provides no suggestion whatsoever that it would have been possible to make the salt sensitive, tapwater dispersible emulsion binder products of the invention.

This *Amendment* is being filed with a *Petition* and fee for a one-month *Extension of Time*. If additional extension or fees are necessary, please consider this a *Petition* therefor and charge any fees to Deposit Account No. 50-0935. Likewise, please charge our Deposit Account if any additional fees are required.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Michael W. Ferrell", written over the typed name.

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